Title: Growing Patterns: How do they grow?

Brief Overview:

Students will engage in hands on activities to build a concrete understanding of growing patterns. In order to do so, students will begin exploring non-numeric patterns in order to create a numeric pattern. This will provide the foundation for algebraic relationships/functions. In the final lesson students will demonstrate their understanding of growing patterns by making a quilt.

NCTM Content Standard/National Science Education Standard:

Understand Patterns, relations, and functions

- Analyze how repeating and growing patterns are generated
- Recognize, describe, and extend patterns such as sequences of sounds and shapes or simple numeric patterns and translate from one representation to another.

Grade/Level:

1-2

Duration/Length:

3 days (60 minutes a day)

Student Outcomes:

Students will:

- Identify, describe, extend, and create numeric patterns
- Identify, describe, extend, and create non-numeric patterns

Materials and Resources:

- Sentence strips
- Pattern blocks
- Overhead pattern blocks
- Poster paper
- Crayons
- Cardstock (or lids from copy paper boxes)
- Various manipulatives (snap cubes, paper clips, buttons, play money, etc…)
- The Keeping Quilt, Patricia Polacco (ISBN: 0689844476)

Suggested Materials

- Quilt with patterns

Development/Procedures:

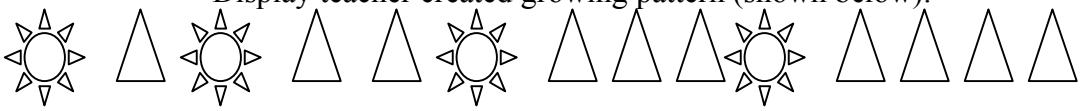
Lesson 1

Pre-assessment –

- Distribute pattern blocks and sentence strips for students to create their own patterns.
- Ask students to trace or draw their patterns on the sentence strips.
- Share student's patterns. Sort the patterns by repeated, growing, and non-examples.
- Questions to ask:
  - What do you notice about your sort?
  - What is happening in each group?
  - What kind of patterns are these?

Launch-

- Discuss student's work by reviewing repeating patterns or highlight any students that may have created a different pattern (growing or non-example).
- Display teacher created growing pattern (shown below).



- Compare the teacher sample to a student repeated pattern sample. Discuss similarities and differences.
- Sample responses:
  - There are some shapes that repeat.
  - Something is being added each time.
  - It is not a repeating pattern (guide students to use the term "growing" to describe the change).

Teacher Facilitation –

- Use the discussion to introduce and define growing patterns and define key vocabulary.
  Growing Patterns: A repeated pattern that builds onto the objects from the first level.
  Level: One full set of objects before reaching the next grouping of objects

- Demonstrate how to build a growing pattern using the overhead pattern blocks. Have the students follow along with their own pattern blocks. Ask students:
    - What is changing? (We are adding new pattern blocks, it is growing.)
    - What is staying the same? (Students should notice that some shapes may not change/grow.)
    - What would come next? (Students should be able to continue to the pattern to the next level.)
- Encourage use of vocabulary. Suggested pattern shown below:
  Triangle, square, triangle, square, square, square, triangle, square, square, square, square, square, triangle, square, square, square, square, square, square, square

Student Application –

- Distribute poster paper that has been cut into horizontal strips (approximately the length of 2 desks) small groups of 4-6 students.
- Distribute crayons so each member of the group has a different colored crayon. (This is essential for the next lesson)
- The first person in the group will create the first level with his or her pattern blocks and then trace onto the paper.
- The person will then pass the poster to the next person in the group. This person will create the next **level** of the growing pattern.
- Continue until all students in the group have created a **level** in the growing pattern.
- Groups will share their finished posters with the class.

Embedded Assessment –

- Distribute exit cards (Student Resource 1). Students will extend the pattern one more level.
- Use informal observations throughout the lesson to determine student's needs. Answer key is on Teacher Resource 1.

Reteaching/Extension –

- For those who have not completely understood the lesson, use manipulatives to build **growing patterns** step by step (Student Resource 2).
- For those who have understood the lesson, have them write to explain the **growing pattern**. Students can also extend the pattern further.

Lesson 2

Preassessment –

- Distribute pre-assessment (Student Resource 3). Students label patterns as repeating or growing.
- Review and discuss responses on overhead (Teacher Resource 3).

- Questions to ask:
  - How do you know the pattern is repeating? (There is a core that is stamped on each level.)
  - How do you know the pattern is growing? (Symbols are added to each level.)

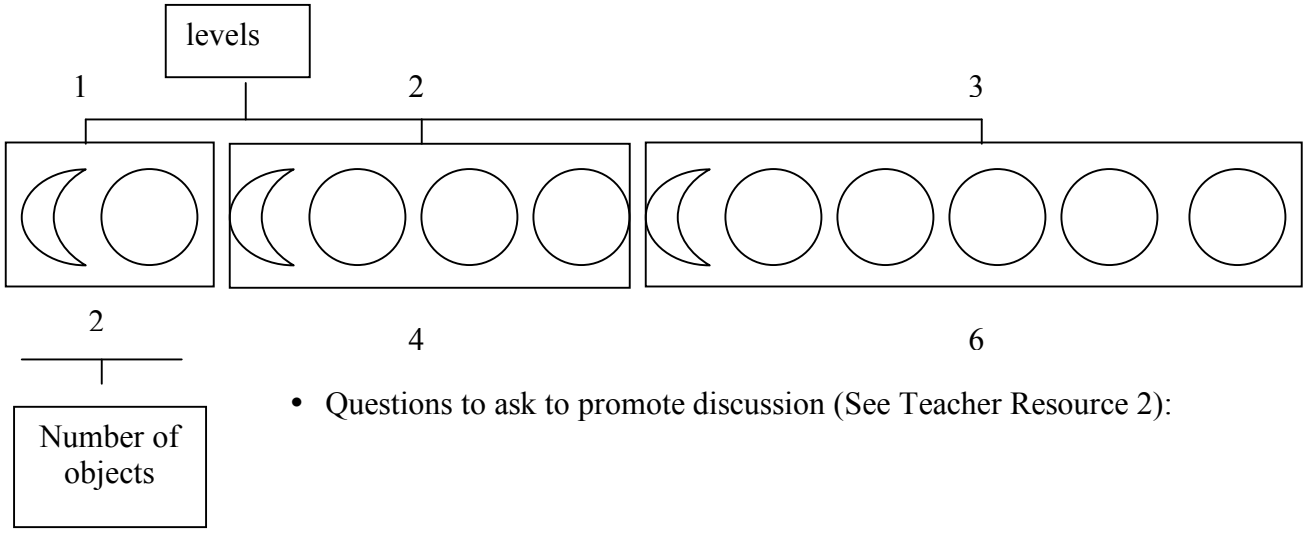
Launch –

- Draw a **growing pattern** on the board. Students should copy the pattern in their journal/scrap paper. Ask students to label the pattern with numbers. Walk around the classroom to observe student responses.

- Students share their responses and thinking process on how to label the **growing pattern**.

Teacher Facilitation –

- Direct student's attention back to the **growing pattern** on the board. Think aloud as you identify the **levels**. Block each **level** to show students. Identify the part of the pattern that repeats on each **level**.
- Label each level in the pattern. Ask students how many objects are in each **level**. Record this underneath each **level** in the pattern (See sample below).
- Sample Dialogue:
  - *Lets look closely at this pattern. I see that a moon and a circle keep repeating. It looks like the moon is the beginning of each new section. We call these the levels in a growing pattern. I am going to draw blocks around each level and number them.*
  - *Lets look at each level. Inside this block, I see 2 objects. Inside the next level, I see 4 objects. In the last level, I see 6 objects. (Teacher may cover the other levels to focus attention on one level at a time.)*
  - *Let's take a look at the numbers and see what we notice (see discussion questions that follow)*



- Questions to ask to promote discussion (See Teacher Resource 2):

- What is changing? (we are adding new objects, it is growing)
- What is staying the same? (students should notice that some shapes may not change/grow)
- How could you extend to the next level? (Students should be able to continue the pattern to the next level.)
- What do you notice about the number of objects on each level? (It is counting by twos.)
- How do you know it is counting by 2's? (Objects are added on each time.)

Student Application –

- Redistribute student created **growing pattern** posters from previous lesson.
- Students must draw blocks around each **level** and number the **levels** and objects.
- Independently, students will complete one of the Student Resource 4 a, b, c, d, e. *Growing Patterns Worksheets.* Group students according to the letter of their worksheet to share their responses and discoveries (Answer key can be found on Teacher Resource 4).
- Students use discussion questions (Teacher Resource 2) to talk about their pattern.
- If time allows, take a gallery walk to examine other student's growing patterns.

Embedded Assessment –

- Distribute the exit card (Student Resource 5) for students to complete. Use this to assess mastery and pre-assess skills for next day's lesson (Answer key can be found on Teacher Resource 5).
- Use informal observations throughout the lesson to determine student's needs.

Reteaching/Extension –

- For those who have not completely understood the lesson, pull students back to work on the railroad activity. Use box tops from copy paper or rectangular shaped cardstock to make railroad cars that will hold the objects in the **levels**. Create a white cloud to go on top of the box for numbering the **levels**. Use a sentence strip to make a railroad track. This is where you will write the amount of objects that are in each **level**. Use various manipulatives to make **growing patterns**. Guide students to fill in level and amount of objects. As you guide students, discuss what you are adding to make the **levels** grow (See Teacher Resources 6a-d for paper copy of activity).
- For those who have understood the lesson, give students number patterns and use the manipulatives to match the **growing pattern**.

Lesson 3

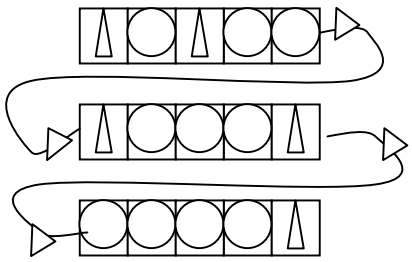
Pre-Assessment –

- Distribute the pre-assessment sheet (Student Resource 6) and have students complete independently. Answer key can be found on Teacher Resource 7.

Launch –

- Read The Keeping Quilt by Patricia Polacco. Discuss the patterns on the quilts in the book. It is suggested to preview the text and highlight pertinent pages that model a quilted pattern. An alternative would be to read the book over the course of the 3 days. (Teacher may bring in a real quilt to show patterns).

Teacher Facilitation –



- Use Student Resources 7a-c *The Giving Quilt* (see Teacher Resource 8a-c for example) to demonstrate the quilting activity. Tell students that they have been chosen to create a new quilt for the sequel to Patricia Polocco's new story "The Giving Quilt". Display Student Resources 7a-c *The Giving Quilt* and model the steps to create the quilt. Be sure to model how to extend the pattern to the next row on the quilt and how to mark the **levels** as the "stitching" of the quilt.

Student Application –

- Invite student volunteers to extend the pattern until the quilt is completed.
- Model copying the first two **levels** of the **growing pattern** to the space provided below the quilt. Students will finish copying the **levels** and labeling the objects and **levels** numerically. Read the directions for the writing activity. Discuss what needs to be included in the written response.

Embedded Assessment –

- Distribute Student Resource 7a-c *The Giving Quit* for students to complete independently.
- Use informal observations throughout the lesson to determine student's needs.

Reteaching/Extension –

- For those who have not completely understood the lesson, work in small groups to provide individual intervention. Use manipulatives to help students build their growing patterns.
- For those who have successfully completed the activity, write a story that matches the quilt they created. Encourage students to use math terms in their story.

Summative Assessment:

- Students will complete an assessment activity (Student Resources 7a-c).
- Students will correctly identify, describe, extend, and create numeric and non-numeric patterns.

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Exit Card

Extend the pattern one more level.

The next level of the pattern will look like this:

Name: _____

Date: _____

Exit Card

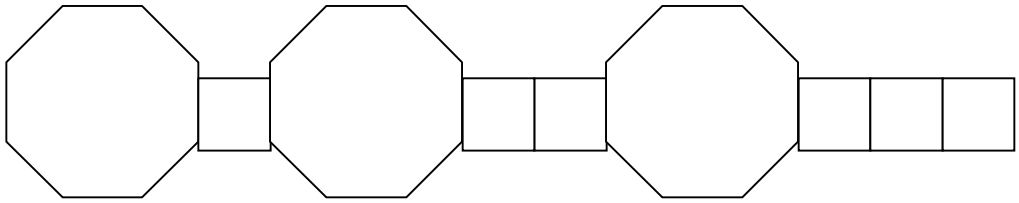
Extend the pattern one more level.

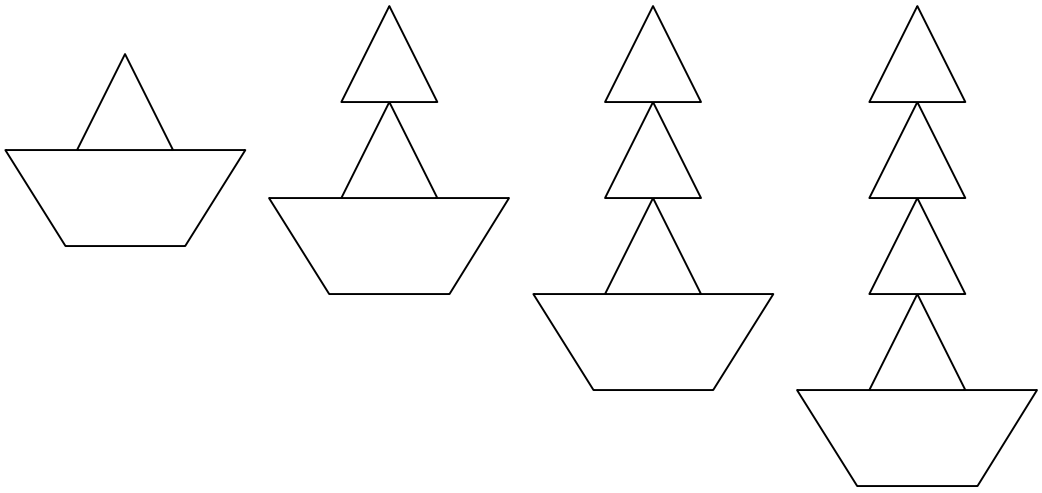
The next level of the pattern will look like this:

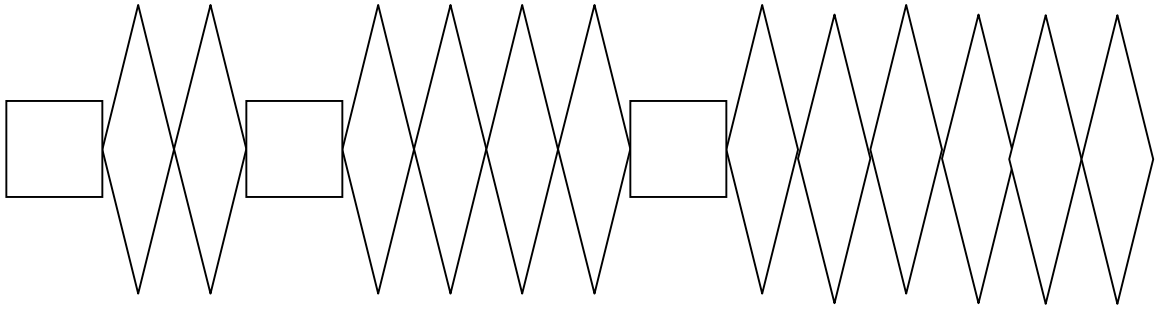
Name: _____

Date: _____

Use manipulatives to continue the patterns.

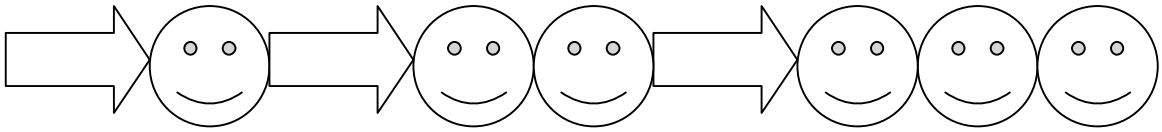




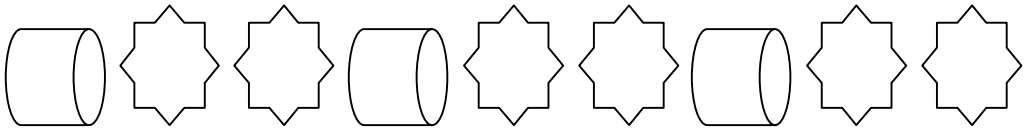


Mixed-Up Patterns

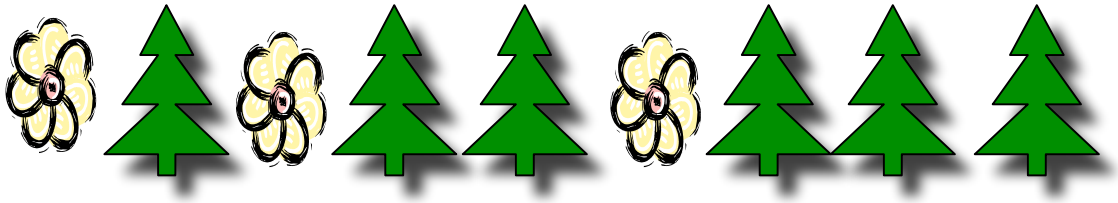
Directions: Using what you know about repeating and growing patterns, identify which pattern is **growing** or **repeating**. Write on the line provided.

1. 

_____ pattern

2. 

_____ pattern

3. 

_____ pattern

Name: _____

Date: _____